WT—1302

OPERATION REDWING—PROJECT 1.2

BLAST MEASUREMENTS on a MEDIUM-YIELD SURFACE BURST(U)

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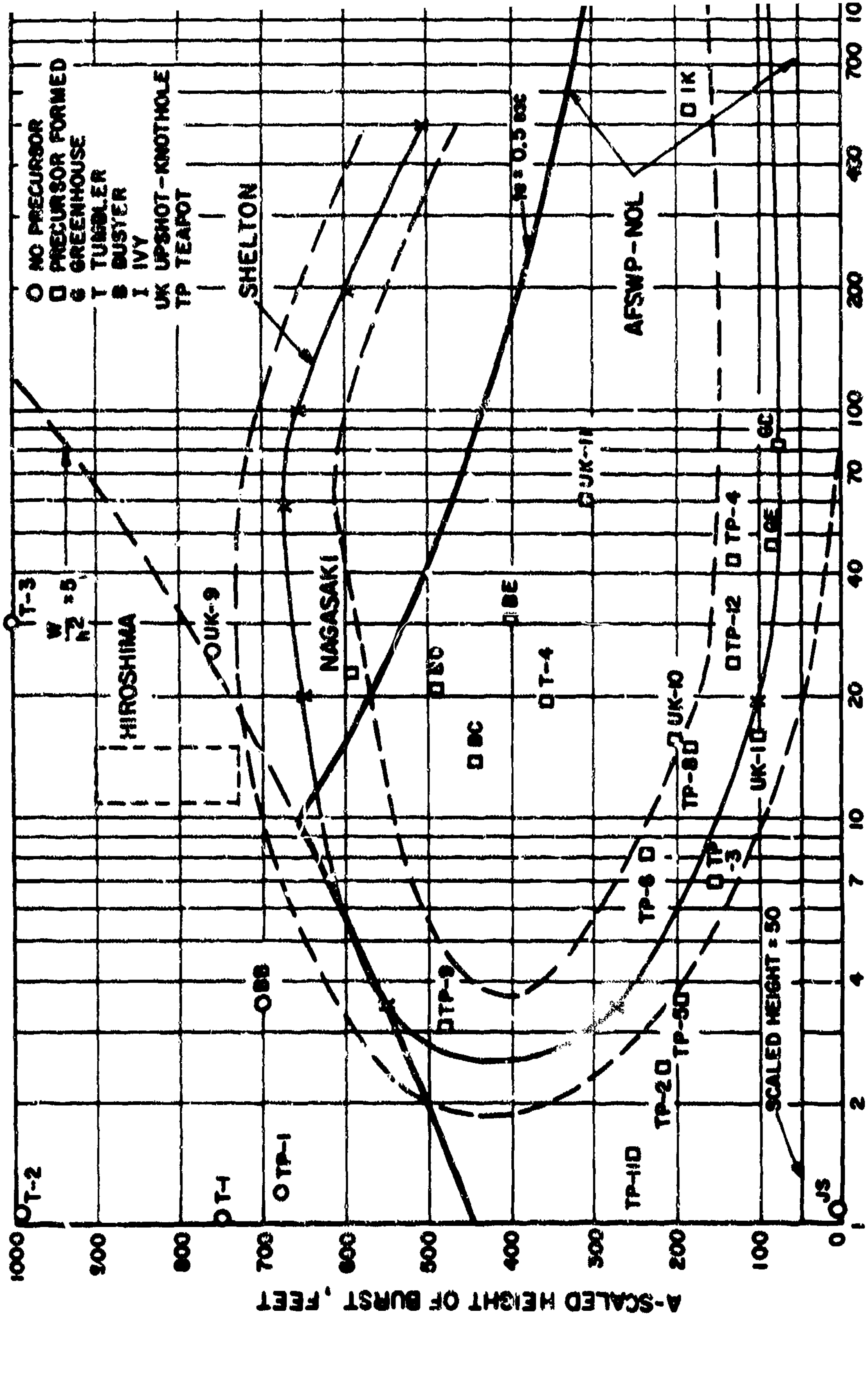

Figure 1.1 Precursor chart.

urements, which were much lower than later and presumably more accurate measurements. only the later measurements were considered the thermal yield would be expected to be about 15 kt. This would not change the relative likelihood of precursor formation between the 40-kt surface burst and the Greenhouse shots, but it would bring them up nearer the Nevada shots above Castle 6 which had little sign of a precursor. The curve marked L is for Shot Lacro… using measured thermal yield, and will be discussed in Chapter 3.

Figure 1.4 shows that the early measurements of thermal yield made by Naval Research Laboratory (NRL) were generally lower than later ones made by either NRL or others. It sh… be noted that if only the later measurements (After Tumbler-Snapper) are considered, there i… no apparent difference in thermal yield of high or low air bursts. Although the lower limit co…

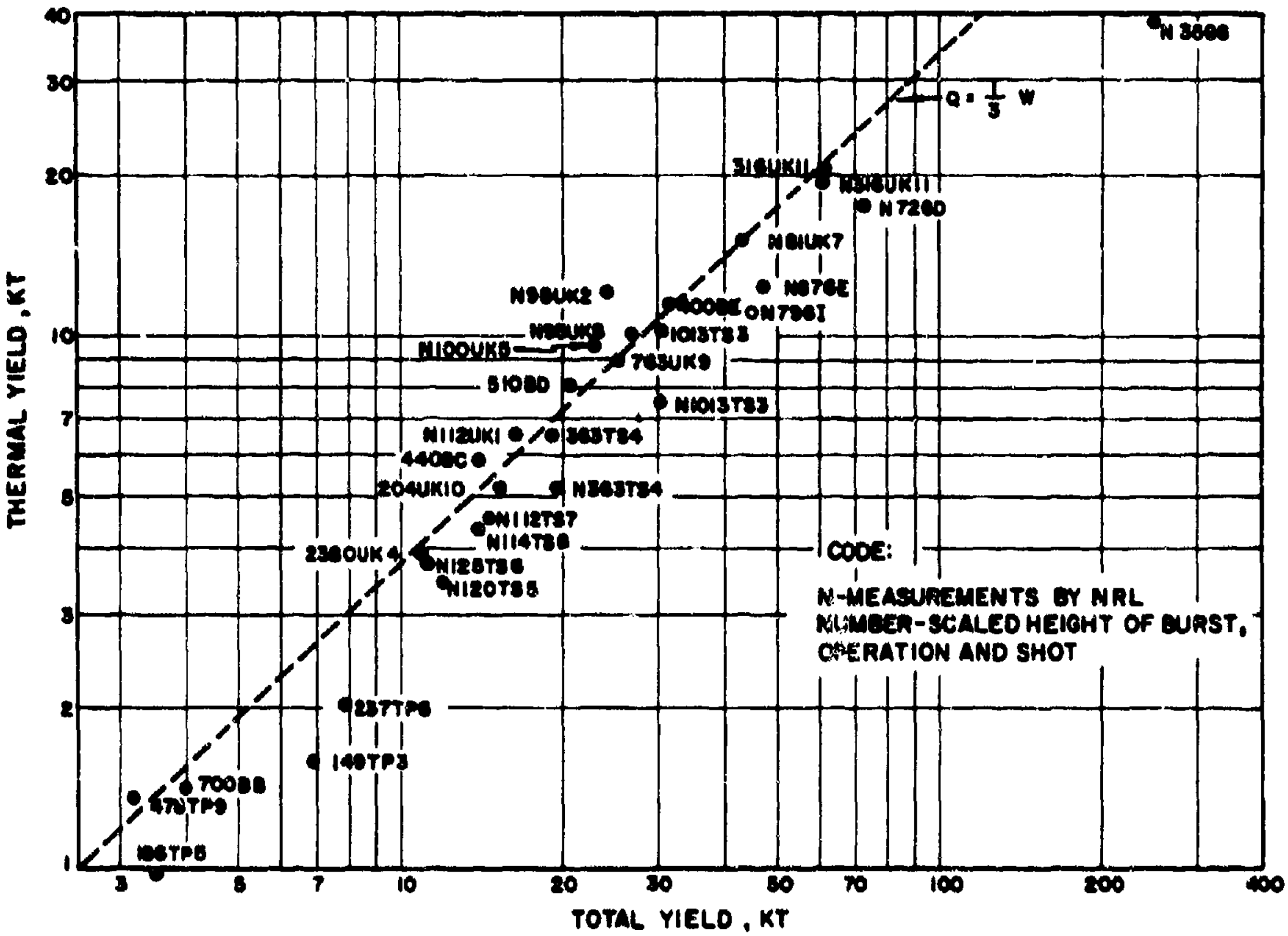

Figure 1.4 Thermal versus total yield.

ered by these measurements is about 100 feet scaled height of burst, this indicates that surfac… bursts should not differ either, since they are similar in shape (hemispherical) to the low air bursts during the radiation of almost all the latter's thermal energy. This means that one sho… not expect any appreciable reduction in thermal for surface bursts compared to air bursts as long as the yield is in the range covered by the observations, i.e., above about 10 kt. The lar… reduction in the thermal yield (one third of an air burst) for the Jangle surface shot, if true, must rapidly become less when the yield increases to 10 kt.

It was evident from the above reasoning that blast measurements on Shot Lacrosse could pr… vide useful information about precursor formation. The calculations presented above show tha…

TABLE 3.1 OVERPRESSURE RESULTS

Station	Ground Range	Gage	Arrival Time	Peak Positive Pressure	Peak Negative Pressure	Positive Pressure Duration	Negative Pressure Duration	Positive Pressure Impulse	Negati Pressu Impul
	ft		sec	psi	psi	sec	sec	psi-sec	psi-se
3021	690	1GBL	0.050	440		Record bad after 0.058 sec			
3021	690	1GBR	0.050	370		Record bad after 0.054 sec			
3021	690	1GBR-RF	0.050	330		Record bad after 0.090 sec			
3022	920	2GBL	0.104	155	¶	0.48	¶	11.6	¶
3022	920	2GBR	0.102	132*		Record bad after 0.113 sec			
3023	1,368	3P3	0.244	84†	4.3	0.43	4.5	4.8	7.7
3023	1,400	3GBL	0.244	58‡	3.7	0.51	4.3	6.1	6.1
3023	1,490	3GBR	0.264	56§	2.5	0.53	3.5	6.5	7.4
120.01	1,793	001P3	0.447	33.9	4.0	0.58	4.4	4.2	6.7
3024	1,825	4GBL	0.462	35	5.5	0.54	4.5	5.0	6.0
3024	1,825	4GBR	0.464	35	3.0	0.54	4.4	5.0	6.6
120.02	2,500	002P3	0.841	17.1	2.1	0.64	4.3	3.3	3.1
121.01	2,500	101GB	0.842	17.8	1.8	0.80	3.9	4.1	3.7
120.03	2,900	003P3	1.096	12.8	1.7	0.84	4.0	3.5	2.6
121.02	2,900	102GB	1.097	12.7	1.8	0.79	4.4	3.4	3.6
120.04	3,250	004P3	1.330	11.0	1.3	0.87	4.6	3.0	4.6

* Peak pressure at 0.110 sec, initial rise 94 psi.
† Peak pressure at 0.268 sec, precursor pressure 14.5 psi.
‡ Peak pressure at 0.292 sec, precursor pressure 19.5 psi.
§ Peak pressure at 0.286 sec.
¶ Not readable.

TABLE 3.3 OVERPRESSURE RESULTS SCALED TO 1 KT, SEA LEVEL

Station	Ground Range	Gage	Arrival Time	Peak Positive Pressure	Peak Negative Pressure	Positive Pressure Duration	Negative Pressure Duration	Positive Pressure Impulse	Negative Pressure Impulse
	ft		sec	psi	psi	sec	sec	psi-sec	psi-sec
3021	202	1GBL	0.0149	442	*	*	*	*	*
3021	202	1GBR	0.0149	372	*	*	*	*	*
3021	202	1GBR-RF	0.0149	332	*	*	*	*	*
3022	270	2GBL	0.0303	156	†	0.14	†	3.5	†
3022	270	2GBR	0.0303	133	*	*	*	*	*
3023	401	3P3	0.0725	84	4.3	0.13	0.13	1.4	2.3
3023	416	3GBL	0.0725	58	3.7	0.15	0.13	1.8	1.8
3023	410	3GBR	0.0784	56	2.5	0.16	0.10	1.9	2.2
120.01	525	001P3	0.133	34	4.0	0.17	0.13	1.3	2.0
3024	535	4GBL	0.137	35	5.5	0.16	0.13	1.5	1.8
3024	535	4GBR	0.138	35	3.0	0.16	0.13	1.5	2.0
120.02	732	002P3	0.250	17.2	2.1	0.19	0.13	1.0	0.9
121.01	732	101GB	0.250	17.9	1.8	0.23	0.12	1.2	1.1
120.03	850	003P3	0.326	12.9	1.7	0.25	0.12	1.0	0.8
121.02	850	102GB	0.326	12.8	1.8	0.23	0.13	1.0	1.1
120.04	952	004P3	0.395	11.1	1.3	0.25	0.14	0.9	1.4

* Record bad.
† Not readable.

TABLE 3.4 DYNAMIC PRESSURE RESULTS SCALED TO 1 KT, SEA LEVEL

Station	Ground Range	Gage	Arrival Time	Peak Dynamic Pressure	Dynamic Pressure Duration	Dynamic Pressure Impulse
	ft		sec	psi	sec	psi-sec
3022	202	2q3	0.0309	236	0.036	3.3
3023	401	3q3	0.0725	181	0.23	2.3
120.01	526	001q3	0.132	22.9	0.068	0.7
120.02	732	002q3	0.250	6.6	0.20	0.28
120.03	850	003q3	0.326	4.0	0.27	0.25

TABLE 3.5 SCALING FACTORS AND AMBIENT CONDITIONS FOR SHOT LACROSSE

Ambient Pressure, P_0: 1008.5 mb
Ambient Temperature, T_0: 300 deg K
Relative Humidity: 84 percent
Winds: 16 knots from 080 degrees
Visibility: Greater than 10 miles
Tide Level: 2.2 feet above mean low water springs

Ground Zero: The device was fired 17 feet above the datum plane in a cab placed on a man-made island. The man-made island and Yvonne itself are about 10 feet above the datum plane. The device was 7 feet above the floor of the cab. The reef on which the man-made island was placed was 1 foot below the datum plane.

Function	Scaling Factor
Distance	$\left(\frac{P_0}{40 \times 14.7}\right)^{1/3} = 0.293$
Pressure	$\frac{14.7}{P_0} = 1.005$
Time	$\left(\frac{T_0}{293}\right)^{1/2} \left(\frac{P_0}{40 \times 14.7}\right)^{1/3} = 0.297$
Impulse	$\left(\frac{T_0}{293}\right)^{1/2} \left(\frac{1}{40}\right)^{1/3} \left(\frac{14.7}{P_0}\right)^{2/3} = 0.298$

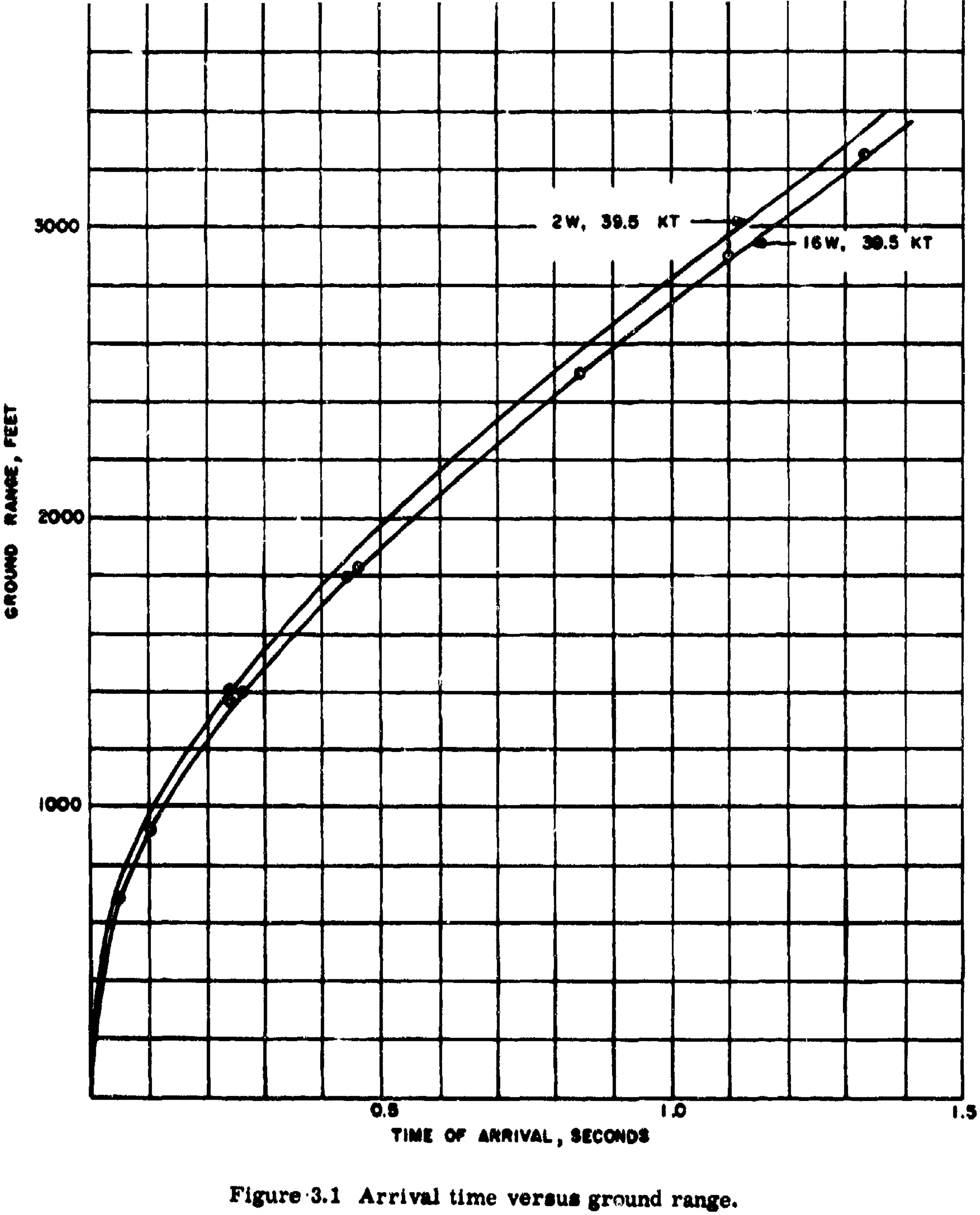

Figure 3.1 Arrival time versus ground range.

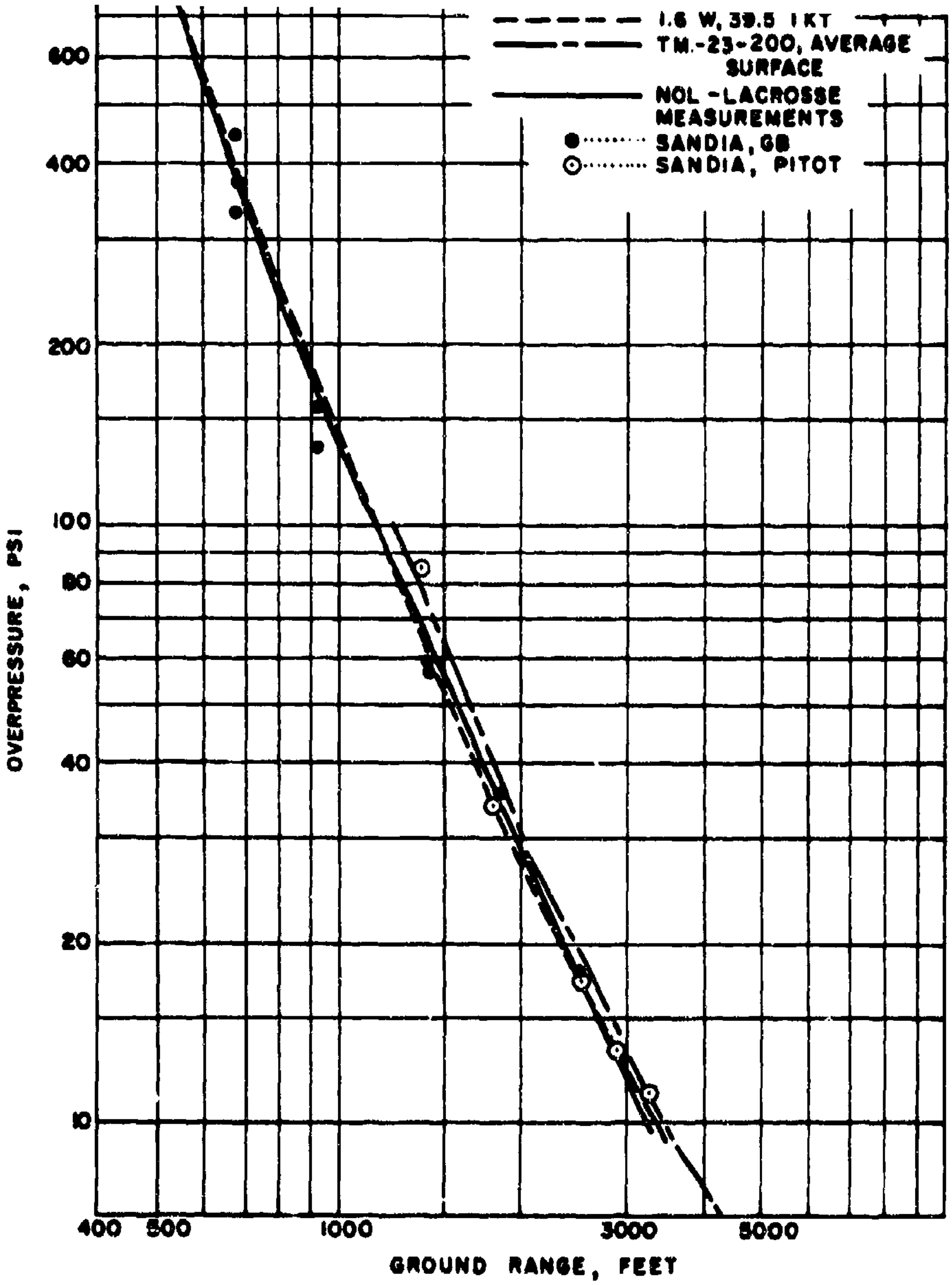

Figure 3.2 Overpressure versus ground range.

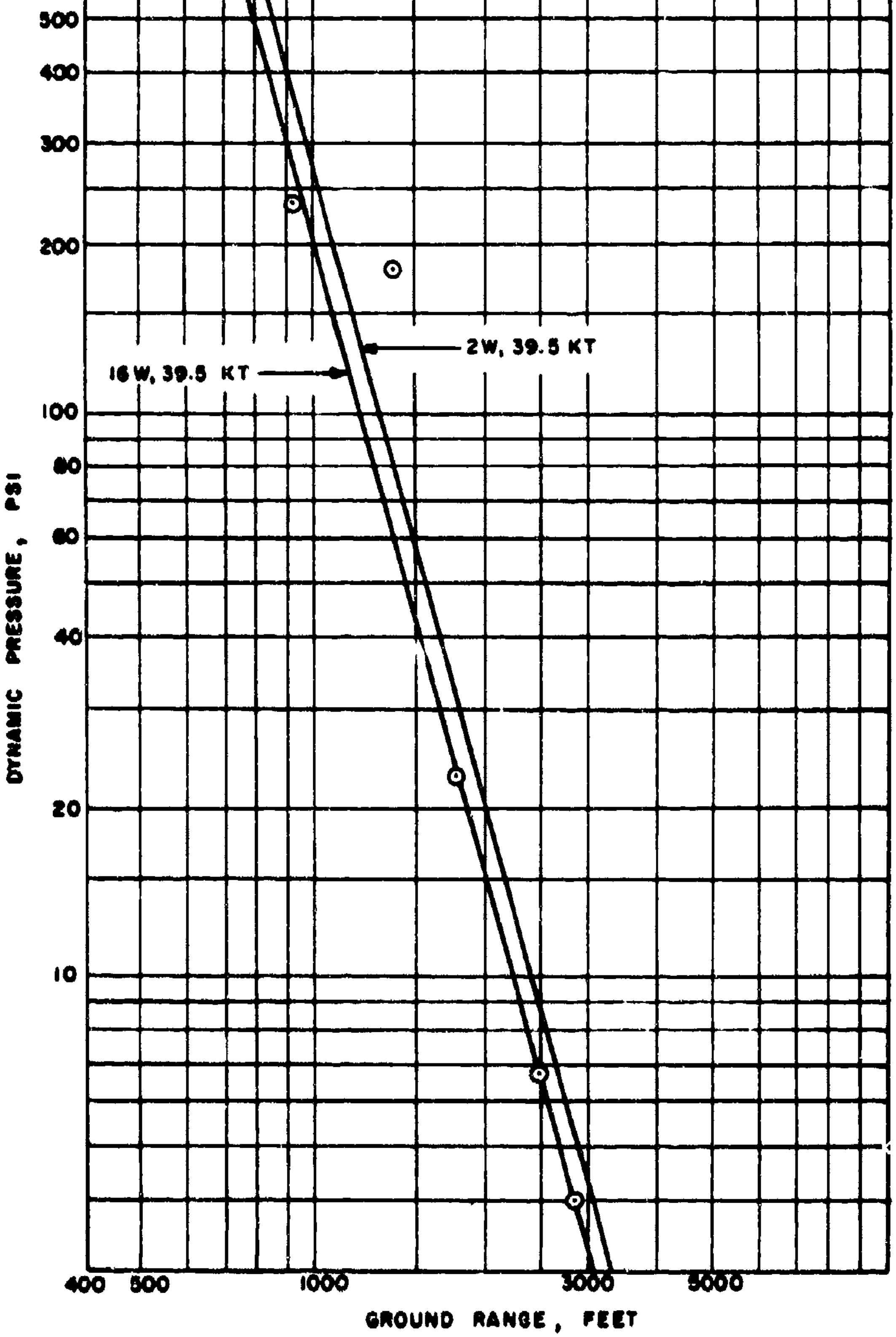

Figure 3.3 Dynamic pressure versus ground range.

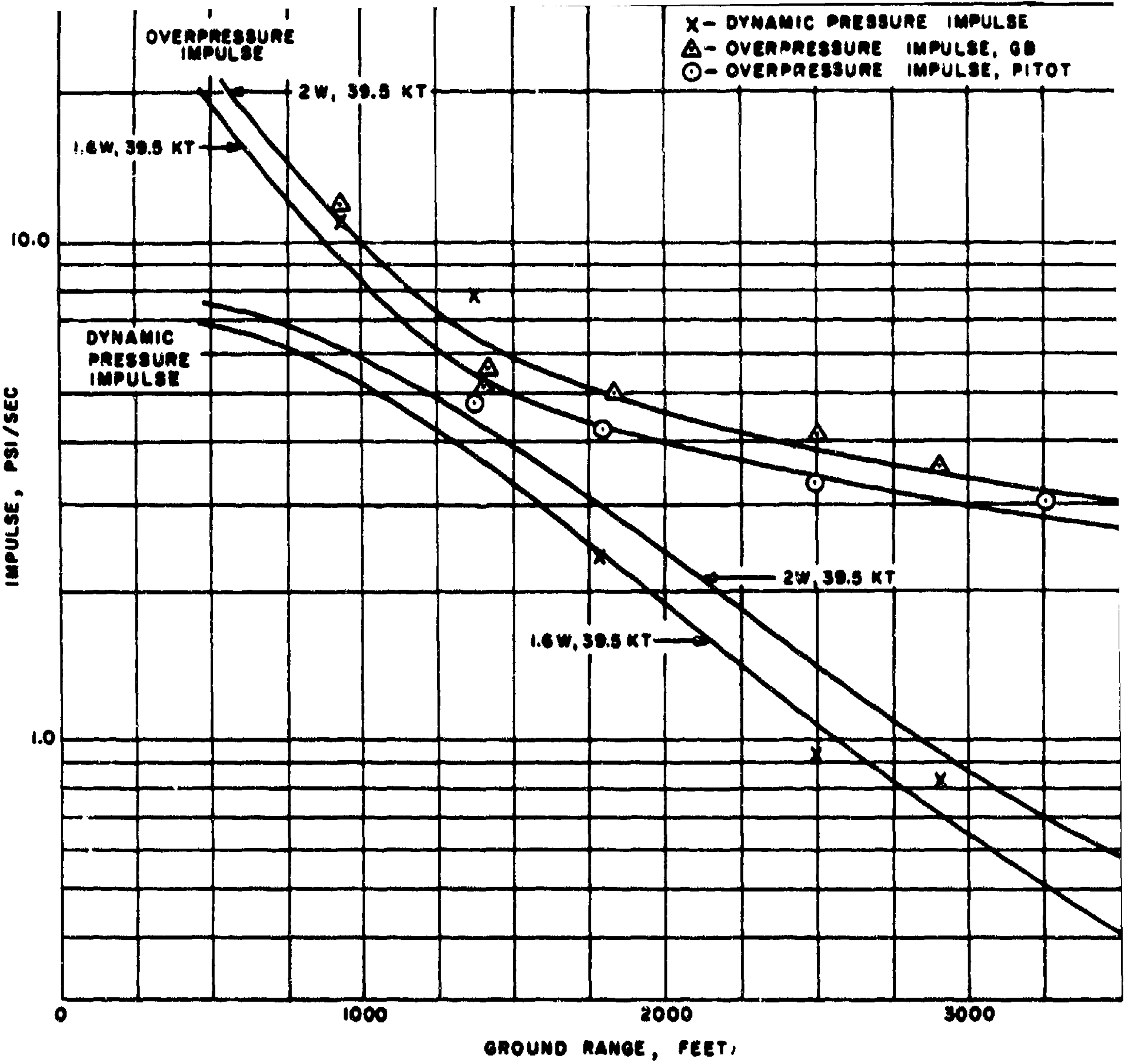

Figure 3.4 Impulse versus ground range.

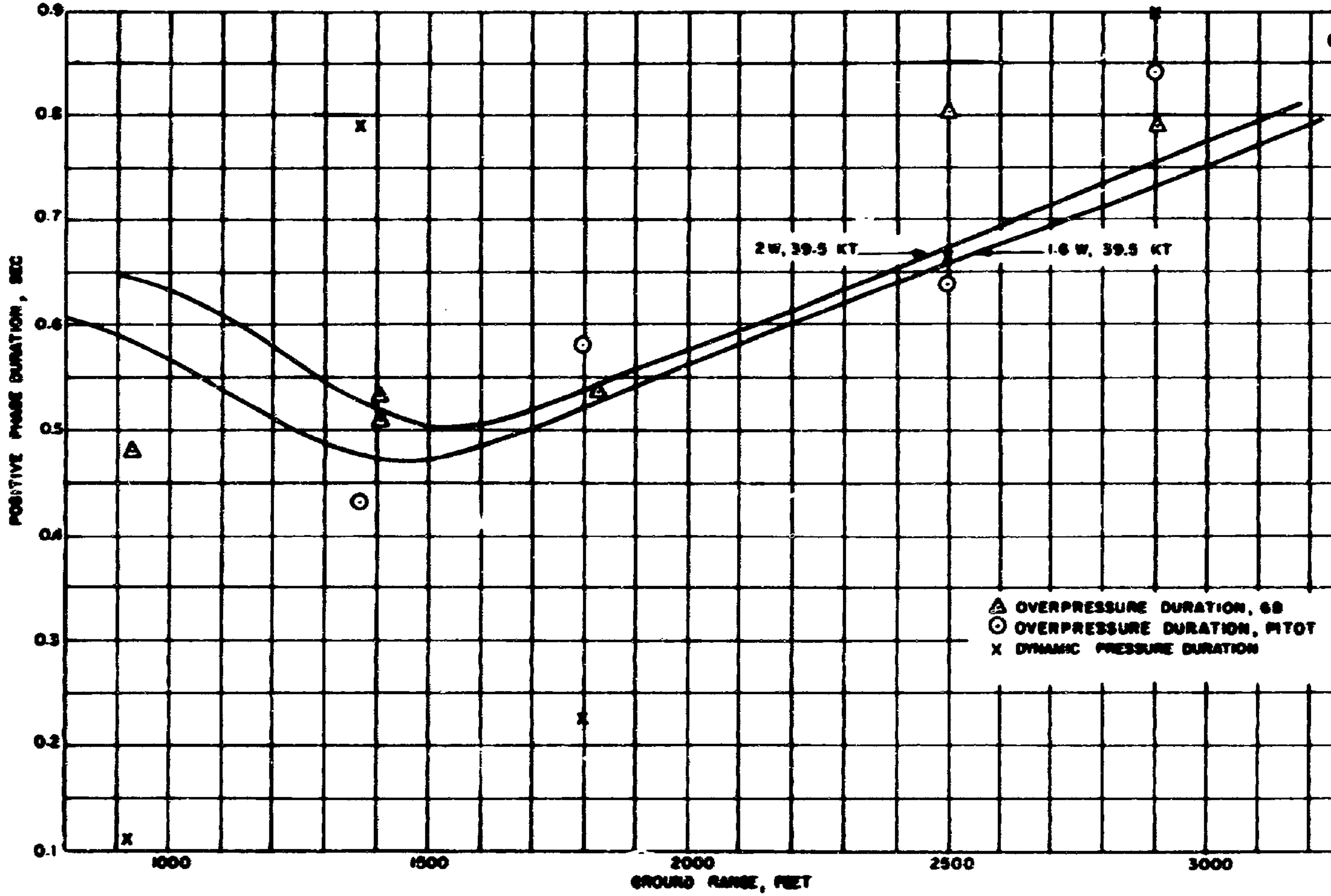

Figure 3.5 Duration versus ground range.

Chapter 4

CONCLUSIONS and RECOMMENDATIONS

4.1 CONCLUSIONS

The measured overpressures and the dynamic pressures were in good agreement with previo measurements (References 3 and 5); that is, they corresponded to the free-air values for 1.6 times the yield of 39.5 kt. A precursor of limited extent was formed that had typical distorted wave forms and for which the dynamic pressure was abnormally high. The evidence from Castl 6, Shot Lacrosse, and Shot Zuni indicates that for surface bursts the severity of the precursor for surface bursts can depend appreciably on the ground surface condition, as well as the facto of shock arrival time and thermal radiation incident normal to the ground. Any attempt to predict in detail requires more information not only for the PPG terrain but for other types of soil surfaces.

4.2 RECOMMENDATIONS

Information about precursor formation on surface bursts is necessary in order to decide hov best to fuze and employ weapons as well as to evaluate their damage capabilities. In order to obtain this information about surfaces of practical importance an experiment over these surface or at least over a dry desert-type surface should be performed so that there will be two points to interpolate between instead of just one point from which to extrapolate.

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